

Color enhances technical articles



I would like to thank PCI for the very nice editorial treatment of our paper, “Corrosion Risk of Bonded, Post-Tensioned Concrete Elements,” in the January–February 2008 issue of *PCI Journal*. The nice use of color did a lot to enhance the usefulness of the reported results.

George Nasser is a tough act to follow, but you certainly seem more than up to the challenge.

Jack Breen

Nasser I. Al-Rashid Chair in Civil Engineering; University of Texas at Austin

Scientific studies in Mazria presentation questionable

I recently read the summary of Edward Mazria’s keynote address at the opening session of the 2007 PCI Annual Convention/Exhibition and National Bridge Conference on page 47 of the January–February 2008 issue of *PCI Journal*. I was amazed at the presentation of questionable scientific studies as fact and further what man can do to reverse the trends.

I would welcome the opportunity to present and/or discuss realities such as the chemical composition of global gases and their reactivity.

It is a shame that in a publication such as *PCI Journal* misinformation and hyperbole are freely dispensed concerning global warming while the balance of the information is based on true scientific studies and real-world applications.

Chuck Durrant

Taylor & Murphy Construction Co.; Asheville, N.C.

Editors’ response

We were reporting on the presentation given by Mr. Mazria at PCI’s October 2007 convention. The *PCI Journal* is probably not the appropriate vehicle to discuss the chemical composition of global gases.

Sign convention needed for prestressed concrete



John F. Stanton is to be commended for bringing up a critical but so far neglected issue in the analysis and design of prestressed concrete—that is, sign convention—in the November–December 2007 *PCI Journal* article “A Simple Sign Convention for Elastic Analysis of Prestressed Concrete Members” on pages 81–88.

Indeed, as mentioned in the paper, this is an open field with different conventions in every book, code, research thesis, and so forth. Yet the benefits of a widely used, preferably universal, sign convention will save millions of hours of guesswork for millions of students and professionals and will minimize the chances of error.

The paper discusses several topics, including the sign convention itself, the choice of notation for stresses, and the application of Magnel’s diagram. All suggestions are rational and offer advantages.

I would like to focus my discussion on two items. In the sign convention proposed, two separate issues are presented. One relates to a recommended convention for the section properties, and the other relates to whether tension should always or mostly be considered positive or negative.

Section properties

Stanton recommends that section properties be given a sign according to their power. Thus an area (of power 2) and a moment of inertia (of power 4) are positive, while a section modulus could be positive or negative, depending on whether it relates to the top or bottom fiber.

In my book *Prestressed Concrete Analysis and Design: Fundamentals*, which was first published in 1982, I had a difficult time deciding on a consistent convention, and I sensed the need to give a sign to certain sectional properties, such as the limits of the central kern, the limits of the limit kern, and the eccentricity of the prestressing steel. However, the distances from the centroid of the section to the top or bottom fibers and the section moduli were all taken positive, as was the prevailing custom at the time.

Stanton's recommendation, as described in the paper, has the advantages of providing a simple and consistent basis that works by itself once the stress equations are set, and of leading to stress equations having the same form. Therefore, I strongly recommend that such an approach be adopted for prestressed concrete throughout and I will try my best to change the convention I use in my book once a new edition is due.

Positive or negative tension

The uniform sign convention for stresses that is proposed by Stanton is predominant in steel structures. Thus, tension is taken as positive and compression as negative. This particular proposal may have advantages in terms of providing uniformity across different structural materials but also may have disadvantages for a good portion of users.

In my book, I selected tension negative for concrete and compression positive, while tension was positive for the steel and compression was negative. This is because we have few cases in which we calculate the stress in the steel and in which the steel is in compression. Even in prestressed columns, the prestressing steel remains in tension up to failure. However, the reinforcing steel in a column is in compression. Thus, to avoid confusion, I would use the absolute value of the compression stress in the steel in some equations. There are few such equations in which the steel is in compression, and this approach minimizes possible errors.

One can select a consistent sign convention that does not need to be uniform for steel and concrete structures. Why would someone who has only dealt with reinforced concrete and prestressed concrete carry a negative sign for compression stresses? This is a matter of preference and discussion.

In this context, and also because of the way that codes are written, one can justify the use of $C_{\text{compression}} = T_{\text{tension}}$ as much as the use of $\Sigma \text{Forces} = 0$. Simply apply that to the equation of equilibrium at ultimate, and clearly the first form is more compatible with the way that codes are generally written.

Therefore, while I do respect the choice of a uniform sign convention for all structural materials, I do not see its clear advantages for those doing most of their work in reinforced and prestressed concrete.

In summary, the fact that I wholeheartedly support the first proposal and have my own reservation about the second indicates that an open discussion is needed among specialists and professionals in the field and that there is a dire need for an in-depth and broader evaluation of the issue. This issue deserves to be seriously considered by a PCI committee with the objective to suggest to its membership, and thus to others at large, a recommended standard.

Antoine (Tony) E. Naaman, PhD, FACI, FASCE, FPCI, FIFS

Professor Emeritus of civil engineering; Department of Civil and Environmental Engineering; University of Michigan; Ann Arbor, Mich.

ERRATA

On page 80 of the January–February 2008 issue of *PCI Journal*, the photo credit should read “Courtesy of Georgia Institute of Technology.”

A bullet point on page 7 of the January–February 2008 issue of *PCI Journal* should read “12 federal agencies, 25 states, and more than 100 municipalities have adopted Leadership in Energy and Environmental Design (LEED) for their public building portfolios.”



Author's response

The interest and comments from Naaman are much appreciated.

Naaman points out that the paper addressed several themes, and he discusses first the proposed system that uses rationally signed section moduli to achieve the correct sign for the stress in the concrete automatically. His support for the approach is much appreciated. I should add that it was only after discussions with him, and with his encouragement, that my paper was even written. It is gracious of him to consider adopting the system for use in his book.

The second issue, namely whether to regard tension or compression as positive, is a matter of personal preference and does not affect the automatic sign-tracking feature of the system. As presented, tension force, stress, and strain are all regarded as positive, and the vertical coordinate y within the cross section is defined as positive downwards. If compression force, stress, and strain were to be regarded as positive and if the common meaning of a positive moment (causing tension stress on the bottom of the member) were to be retained, then the vertical coordinate would have to be defined as positive upwards to give the correct signs for the stresses. This can, of course, be done without difficulty. The system works equally well either way.

However, old habits die hard and trying to coerce all engineers to treat tension as positive—or vice versa—is probably beneficial in the long run but the transition might be tricky. It would be interesting to hear PCI members' arguments for each choice.

At least two rational approaches to the matter appear possible. One is to treat tension as positive, regardless of the material in which it occurs. It is then logical to write the equation of equilibrium in the form $\sum F = 0$, and in it to sum the forces in the concrete(s), any reinforcing steel, and the prestressing strand. The resulting signs will indicate the senses of the stresses with no intervention from the user.

The second approach is to treat tension in steel and compression in concrete as positive, as Naaman suggests, and to write $T = C$. The advantages of the first approach include consistency with other disciplines (for example, timber and structural steel, and even textbooks on mechanics) and the preservation of precious mental capacity for matters weightier than tracking signs. Proponents of the second approach would argue that it is easier to treat as positive the natural stress state in each material. However, because both tension and compression stress are routinely computed in the (prestressed) concrete, one of them will be negative anyway, so there is no absolute escape from the dreaded negative sign. Furthermore, there is room for argument about the *natural* stress state in reinforcement. My preference therefore lies with the first approach.

It is worth noting that ACI 318-05 provides no useful leadership on the matter. A glance at the list of symbols for axial force in chapter 2, "Notation," shows that even among the N values, some are positive in tension while others are positive in compression. Furthermore, in chapter 18, stress limits are all positive, regardless of the sense of the stress.

John F. Stanton

Professor; Department of Civil Engineering; University of Washington; Seattle, Wash.

PCI Journal redesign has some flaws

You may not like me for this, but you asked for feedback on the redesigned *PCI Journal* so here goes.

- The significance of the two inequality signs is lost except to add clutter to the page. When they point down, it is even more confusing.
- The use of two-color, two-font styles in headings with no line spacing makes them hard to read.
- Black lettering on dark blue background (such as in the November–December 2007 issue on page 21) and white lettering on a light background (on page 36) are hard to read.
- The use of headings across the gutter makes them impossible to read (such as those on pages 32 and 33 of the November–December 2007 issue).
- The use of alternating color bands in tables and other places results in unequal emphasis, so it is hard to focus on every line.
- Please avoid the use of overcrowded figures that are hard to read. This comment also applies to previous issue of *PCI Journal*.
- The use of the two-column format with unequal widths leaves me confused.
- What is the red mark after the last reference in the technical articles?
- Is the weird square at the top outside corner really necessary? The technical articles already have a nonwhite background and a colored bar across the top to differentiate them. The connection between this square and the theme is lost.
- How could you ever allow the top figure on page 68 of the January–February 2008 issue or the drawings on pages 70 and 71?
- As a person who usually reads *PCI Journal* in poorly lighted airports, airplanes, and hotels, the redesigned journal is a lot more difficult to read than the previous version.

Good layout should result in a product that is easy to read so that the reader can focus on the content. Many *PCI Journal* readers are engineers who are interested in facts and information and not fuzzy, busy layouts. For the past two issues, I have found myself focusing on the layout and not the content.

Please consider some simplification.

Henry G. Russell

Henry G. Russell Inc.; Glenview, Ill.

COMMENTS?

The editors welcome discussion of *PCI Journal* content. Comments must be confined to the scope of the article under discussion. All discussion of articles in this issue must be received by August 1, 2008.

Please address reader comments to *PCI Journal* editor-in-chief Emily Lorenz at elorenz@pci.org or Precast/Prestressed Concrete Institute, c/o *PCI Journal*, 209 W. Jackson Blvd., Suite 500, Chicago, IL 60606.

Letters should include the writer's name, title, company, city, and email address or phone number and may be sent to respective authors for comment. All letters become the property of *PCI Journal* and may be edited for space, clarity, and style.